

1 1. (Currently Amended) A method for generating faster discrete cosine
2 transforms, comprising:
3 arranging discrete cosine transform equations into collections, wherein at least one
4 collection includes [of] at least two discrete transform equations, and wherein the
5 [collection] at least two discrete transform equations includes at least two discrete cosine
6 transform constants;
7 scaling the discrete cosine transform equations in [the at least one] a collection by
8 dividing each of the discrete cosine transform constants in the collection by one [of the]
9 discrete cosine transform [constants] constant from the [at least one] collection; and
10 representing each of the scaled discrete cosine transform constants with sums of
11 powers-of-2, wherein the sums of powers-of-2 are calculated to approximate [that are
12 approximations for] the scaled discrete cosine transform constants.

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1 2. (Original) The method of claim 1 further comprising separating an image
2 into at least one block and transforming the block into transformed data by performing matrix
3 multiplication on the discrete cosine transform equations based upon binary arithmetic using
4 the estimated scaled discrete cosine transform constants and performing linear shifts and
5 additions.

1 3. (Original) The method of claim 1 wherein the scaling the discrete cosine
2 transform equations in the at least one collection by dividing each of the discrete cosine
3 transform constants in the at least one collection by one of the discrete cosine transform
4 constants from the at least one collection saves multiplications.

1 4. (Original) The method of claim 1 wherein the discrete cosine transform
2 constant chosen for scaling the discrete cosine transform equations in the at least one
3 collection is selected according to a predetermined cost function.

1 5. (Original) The method of claim 4 wherein the cost function minimizes a
2 number of add operations.

1 6. (Original) The method of claim 4 wherein the cost function minimizes a
2 worst case number of add operations.

1 7. (Original) The method of claim 4 wherein the cost function minimizes an
2 error per constant resulting from the approximations.

1 8. (Original) The method of claim 2 wherein the transforming the block into
2 transformed data further comprises using at least one set of one dimensional discrete cosine
3 transform equations.

1 9. (Original) The method of claim 8 wherein the discrete cosine transform
2 constants are obtained by splitting the discrete cosine transform constants into even and odd
3 terms by obtaining sums and differences of input samples.

1 10. (Original) The method of claim 2 wherein the block is an $N_1 \times N_2$ block.

1 11. (Original) The method of claim 10 wherein $N_1 = N_2 = 8$.

1 12. (Currently Amended) A data compression system, the data
2 compression system comprising a discrete cosine transformer for applying a discrete cosine
3 transform to decorrelate data into discrete cosine transform equations, the discrete cosine
4 transform equations having been formed by arranging discrete cosine transform equations
5 into collections, wherein at least one collection includes [of] at least two discrete transform
6 equations, and wherein the [collection] at least two discrete transform equations includes at
7 least two discrete cosine transform constants, scaling the discrete cosine transform equations
8 in [the at least one] a collection by dividing each of the discrete cosine transform constants
9 in the collection by one [of the] discrete cosine transform [constants] constant from the [at
10 least one] collection and representing each of the scaled discrete cosine transform constants
11 with sums of powers-of-2, wherein the sums of powers-of-2 is calculated to approximate [
12 that are approximations for] the scaled discrete cosine transform constants.

1 13. (Original) The data compression system of claim 12 further comprising a
2 quantizer for quantizing the transformed data into quantized data to reduce the number of bits
3 needed to represent the transform coefficients.

1 14. (Original) The data compression system of claim 12 wherein the discrete
2 cosine transformer further separates an image into at least one block and transforms the block
3 into transformed data using the discrete cosine transform equations based upon binary
4 arithmetic using the estimated scaled discrete cosine transform constants and performing
5 linear shifts and additions.

1 15. (Original) The data compression system of claim 12 wherein the
2 transformer executes equations that save multiplication operations, the equations having been
3 formed by scaling the discrete cosine transform equations in the at least one collection by
4 dividing each of the discrete cosine transform constants in the at least one collection by one
5 of the discrete cosine transform constants from the at least one collection.

1 16. (Original) The data compression system of claim 15 further comprising
2 an entropy encoder for further compressing the quantized coefficients losslessly.

1 17. (Original) The data compression system of claim 12 wherein the discrete
2 cosine transform constant used for scaling the discrete cosine transform equations in the at
3 least one collection is selected according to a predetermined cost function.
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1 18. (Original) The data compression system of claim 17 wherein the cost
2 function minimizes a number of add operations.

1 19. (Original) The data compression system of claim 17 wherein the cost
2 function minimizes a worst case number of add operations.

1 20. (Original) The data compression system of claim 17 wherein the cost
2 function minimizes an error per constant resulting from the approximations.

1 21. (Original) The data compression system of claim 12 wherein discrete
2 cosine transformer uses at least one set of one dimensional discrete cosine transform
3 equations.

1 22. (Original) The data compression system of claim 22 wherein the
2 equations split the discrete cosine transform coefficients into even and odd terms by
3 obtaining sums and differences of input samples.

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1 23. (Original) The data compression system of claim 14 wherein the block is
2 an $N_1 \times N_2$ block.

1 24. (Original) The data compression system of claim 23 wherein $N_1 = N_2 = 8$.

1 25. (Currently Amended) A printer, comprising:
2 a memory for storing data;
3 a processor for processing the data to provide a compressed print stream output; and
4 a printhead driving circuit for controlling a printhead to generate a printout of the
5 data;

6 wherein the processor applies a discrete cosine transform to decorrelate data into
7 transform coefficients using discrete cosine equations, the discrete cosine transform
8 equations having been formed by arranging discrete cosine transform equations into
9 collections, wherein at least one collection includes [of] at least two discrete transform
10 equations, and wherein the [collection] at least two discrete transform equations includes at
11 least two discrete cosine transform constants, scaling the discrete cosine transform equations
12 in [the at least one] a collection by dividing each of the discrete cosine transform constants
13 in the collection by one [of the] discrete cosine transform [constants] constant from the [at
14 least one] collection and representing each of the scaled discrete cosine transform constants
15 with sums of powers-of-2, wherein the sums of powers-of-2 is calculated to approximate [
16 that are approximations for] the scaled discrete cosine transform constants.

1 26. (Original) The printer of claim 25 wherein the processor further separates
2 an image into at least one block and transforms the block into transformed data by
3 performing matrix multiplication on the discrete cosine transform equations based upon
4 binary arithmetic using the estimated scaled discrete cosine transform constants and
5 performing linear shifts and additions.

1 27. (Original) The printer of claim 25 wherein the processor executes
2 equations that save multiplication operations, the equations having been formed by scaling
3 the discrete cosine transform equations in a collection by dividing each of the discrete cosine
4 transform constants in the at least one collection by one of the discrete cosine transform
5 constants from the at least one collection.

1 28. (Original) The printer of claim 25 wherein the discrete cosine transform
2 constant used in scaling the discrete cosine transform equations in the at least one collection
3 is selected according to a predetermined cost function.

1 29. (Original) The printer of claim 28 wherein the cost function minimizes a
2 number of add operations.

1 30. (Original) The printer of claim 28 wherein the cost function minimizes a
2 worst case number of add operations.

1 31. (Original) The printer of claim 28 wherein the cost function minimizes an
2 error per constant resulting from the approximations.

1 32. (Original) The printer of claim 25 wherein processor uses at least one set
2 of one dimensional discrete cosine transform equations.

1 33. (Original) The printer of claim 32 wherein the processor splits the discrete
2 cosine transform coefficients into even and odd terms by obtaining sums and differences of
3 input samples.

1 34. (Original) The printer of claim 26 wherein the block is an $N_1 \times N_2$ block.

1 35. (Original) The printer of claim 34 wherein $N_1 = N_2 = 8$.

1 36. (Currently Amended) An article of manufacture comprising a program
2 storage medium readable by a computer, the medium tangibly embodying one or more
3 programs of instructions executable by the computer to use equations created by a method for
4 generating faster discrete cosine transforms, the method comprising:

5 arranging discrete cosine transform equations into collections, wherein at least one
6 collection includes [of] at least two discrete transform equations, and wherein the
7 [collection] at least two discrete transform equations includes at least two discrete cosine
8 transform constants;

9 scaling the discrete cosine transform equations in [the at least one] a collection by
10 dividing each of the discrete cosine transform constants in the collection by one [of the]
11 discrete cosine transform [constants] constant from the [at least one] collection; and
12 representing each of the scaled discrete cosine transform constants with sums of
13 powers-of-2, wherein the sums of powers-of-2 are calculated to approximate [that are
14 approximations for] the scaled discrete cosine transform constants.

1 37. (Original) The article of manufacture of claim 36 further comprising
2 separating an image into at least one block and transforming the block into transformed data
3 by using discrete cosine transform equations based upon binary arithmetic using the
4 estimated scaled discrete cosine transform constants and performing linear shifts and
5 additions.

1 38. (Original) The article of manufacture of claim 36 wherein the scaling the
2 discrete cosine transform equations in the at least one collection by dividing each of the
3 discrete cosine transform constants in the at least one collection by one of the discrete cosine
4 transform constants from the at least one collection saves multiplications.

1 39. (Original) The article of manufacture of claim 36 wherein the discrete
2 cosine transform constant chosen for scaling the discrete cosine transform equations in the at
3 least one collection is selected according to a predetermined cost function.

1 40. (Original) The article of manufacture of claim 39 wherein the cost
2 function minimizes a number of add operations.

1 41. (Original) The article of manufacture of claim 39 wherein the cost
2 function minimizes a worst case number of add operations.

1 42. (Original) The article of manufacture of claim 39 wherein the cost
2 function minimizes an error per constant resulting from the approximations.

1 43. (Original) The article of manufacture of claim 36 wherein the
2 transforming the block into transformed data further comprises using at least one set of one
3 dimensional discrete cosine transform equations.

1 44. (Original) The article of manufacture of claim 43 wherein the discrete
2 cosine transform constants are obtained by splitting the discrete cosine transform constants
3 into even and odd terms by obtaining sums and differences of input samples.

1 45. (Original) The article of manufacture of claim 37 wherein the block is an
2 $N_1 \times N_2$ block.

1 46. (Original) The article of manufacture of claim 45 wherein $N_1 = N_2 = 8$.

1 47. (Currently Amended) A data analysis system, comprising;
2 a memory for storing discrete cosine transform equations having been formed by arranging
3 discrete cosine transform equations into collections, wherein at least one collection includes [
4 of] at least two discrete transform equations, and wherein the [collection] at least two
5 discrete transform equations includes at least two discrete cosine transform constants, scaling
6 the discrete cosine transform equations in [the at least one] a collection by dividing each of
7 the discrete cosine transform constants in the collection by one [of the] discrete cosine
8 transform [constants] constant from the [at least one] collection and representing each of
9 the scaled discrete cosine transform constants with sums of powers-of-2, wherein the sums of
10 powers-of-2 is calculated to approximate [that are approximations for] the scaled discrete
11 cosine transform constants; and
12 a transformer for applying the transform equations to perform a discrete cosine
13 transform to decorrelate data into discrete cosine transform coefficients.

1 48. (Original) The data analysis system of claim 47 wherein the transformer
2 further separates an image into at least one block and transforms the block into transformed
3 data by using the discrete cosine transform equations based upon binary arithmetic using the
4 estimated scaled discrete cosine transform constants and performing linear shifts and
5 additions.

- 1 49. (Original) The data analysis system of claim 47 wherein the discrete
C1 cosine transform constant used for scaling the discrete cosine transform equations in the at
2 least one collection is selected according to a predetermined cost function.
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